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MAN83740R3 04/06

Instruction Manual

HI 83740 COPPER ISM for wine analysis



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Dear Customer,

Thank you for choosing a Hanna product. This manual will provide you with the necessary information for the correct use of the instrument. Please read it carefully before using the meter. If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com.

This instrument is in compliance with CE directives.

TABLE OF CONTENTS

HANNA LITERATURE

Hanna publishes a wide range of catalogs and handbooks for an equally wide range of applications. The reference literature currently covers areas such as:

- Water Treatment
- Process
- Swimming Pools
- Agriculture
- Food
- Laboratory

and many others. New reference material is constantly being added to the library.

For these and other catalogs, handbooks and leaflets contact your dealer or the Hanna Customer Service Center nearest to you. To find the Hanna Office in your vicinity, check our home page at www.hannainst.com.

CE DECLARATION OF CONFORMITY

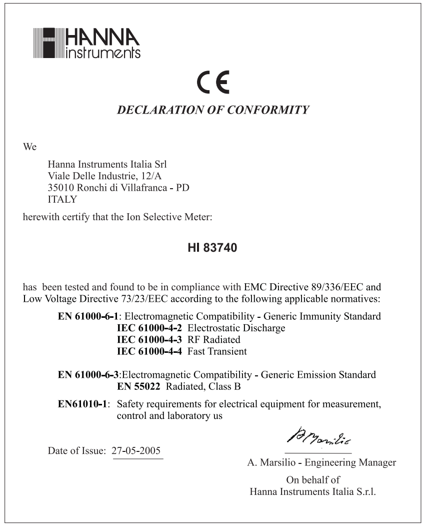
Recommendations for Users

Before using these products, make sure that they are entirely suitable for your specific application and for the environment in which they are used.

Operation of these instruments may cause unacceptable interferences to other electronic equipments, this requiring the operator to take all necessary steps to correct interferences.

Any variation introduced by the user to the supplied equipment may degrade the instruments' EMC performance.

To avoid damages or burns, do not put the instrument in microwave ovens. For yours and the instrument safety do not use or store the instrument in hazardous environments.



DECLARATION OF CONFORMITY

We

Hanna Instruments Italia Srl
Viale Delle Industrie, 12/A
35010 Ronchi di Villafranca - PD
ITALY

herewith certify that the Ion Selective Meter:

HI 83740

has been tested and found to be in compliance with EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC according to the following applicable normatives:

EN 61000-6-1: Electromagnetic Compatibility - Generic Immunity Standard
IEC 61000-4-2 Electrostatic Discharge
IEC 61000-4-3 RF Radiated
IEC 61000-4-4 Fast Transient

EN 61000-6-3:Electromagnetic Compatibility - Generic Emission Standard
EN 55022 Radiated, Class B

EN61010-1: Safety requirements for electrical equipment for measurement, control and laboratory us

Date of Issue: 27-05-2005

A. Marsilio - Engineering Manager
On behalf of
Hanna Instruments Italia S.r.l.

WARRANTY

HI 83740 is warranted for two years against defects in workmanship and materials when used for its intended purpose and maintained according to the instructions.

This warranty is limited to repair or replacement free of charge.

Damages due to accident, misuse, tampering or lack of prescribed maintenance are not covered.

If service is required, contact your dealer. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charges incurred.

If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization Number from the Customer Service Department and then send it with shipment costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

To validate your warranty, fill out and return the enclosed warranty card within 14 days from the date of purchase.

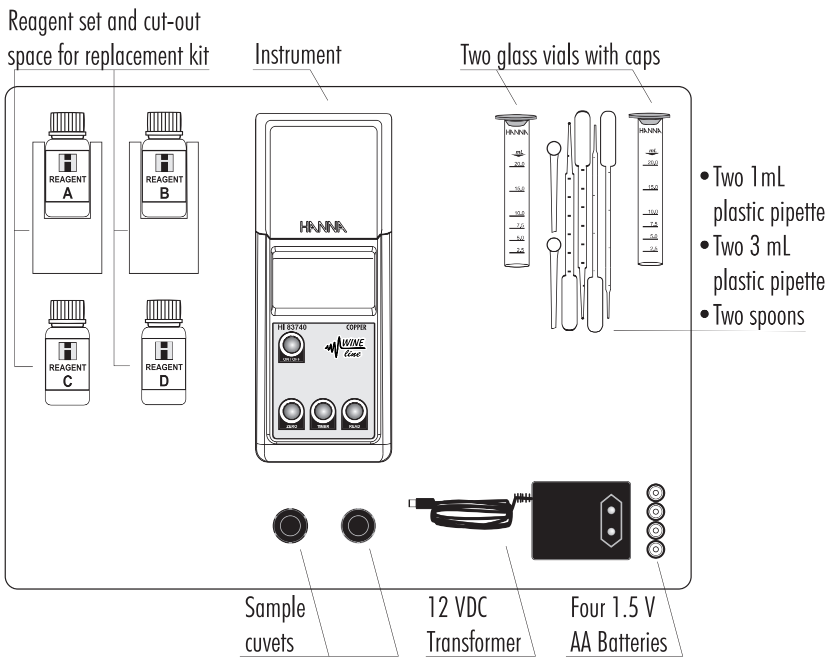
Hanna Instruments reserves the right to modify the design, construction and appearance of its products without advance notice.

PRELIMINARY EXAMINATION

Please examine this product carefully. Make sure that the instrument is not damaged. If any damage occured during shipment, please notify your Dealer.

Each **HI 83740** Ion Selective Meter is supplied complete with:

- Two sample cuvets and caps
- Reagents for 5 tests (HI 83740A-0, HI 83740B-0, HI 83740C-0, HI 83740D-0)
- Two 20 mL glass vials with caps
- Two 1 mL plastic pipette, two 3 mL plastic pipette, two spoons.
- 12 VDC transformer (**HI 710005** or **HI 710006**)
- Four 1,5V AA batteries
- Tissue for wiping cuvets
- Instruction manual
- Instrument Quality Certificate
- Rigid carrying case



<u>Note:</u> save all packing material until you are sure that the instrument works correctly. Any defective item must be returned in its original packing.

GENERAL DESCRIPTION

The **HI 83740** is an auto-diagnostic portable microprocessor meter that benefits from Hanna's years of experience as a manufacturer of analytical instruments. It has an advanced optical system based on a special tungsten lamp and a narrow band interference filter that allows most accurate and repeatable readings. All instruments are factory calibrated.

The auto-diagnostic feature of this meter ensures always optimal measurement conditions to ensure most precise readings. The light level is automatically adjusted each time a zero-measurement is made, and the temperature of the lamp is controlled to avoid overheating.

SIGNIFICANCE OF USE

Grapes accumulate normally only a small amount of copper by natural translocation from roots. Unless exposed to significant airborne pollution or vineyard sprays, increased concentrations in wine result from contamination during post-fermentation processing, like contact with non stainless steel equipment and as impurities in fining agents and filter media.

The copper concentration in wine is normally low, less than 0.10 to 0.30 mg/L, because excess copper is precipitated during fermentation due to adsorption onto the yeast cells. This adsorption and precipitation can reduce the initial copper concentration with 40 to 89%. At higher concentration copper plays an important role in catalysing oxidation reactions of wine phenols.

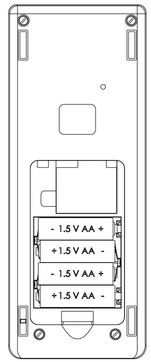
It is important to check the copper content both in must and in wine, because at levels above 9 mg/L copper becomes a metabolic toxin that inhibits or delays alcoholic fermentation, and concentrations exceeding 1 mg/L may be sensorial detected and should be avoided.

Other copper related problems can be manifested as formation of white haze (in white wines) and later as a reddish-brown amorphous precipitate. This precipitated 'casse' develops only under the strongly reducing conditions found in bottled wines. It has been found that this casse is a mixture of copper compounds and proteins.

Factors favouring and inhibiting copper casse formulation in wine

Necessary conditions for copper casse formation	Preventive Measures
strong reducing conditions	copper levels at less than 0.3 mg/L
low iron concentrations	limit SO_2 addition
high protein levels	cold-stabilize and bentonite fine to reduce proteins in white wine
light and heat	

BATTERIES REPLACEMENT



Battery replacement must only take place in a non-hazardous area.

The blinking “ ” will appear when the batteries power gets low.

When batteries are completely discharged, “0% bAtt” will appear and after two seconds the instrument is switched off.

Remove the battery cover from the bottom of the instrument and change the old batteries with 4 fresh 1.5V batteries, paying attention to the correct polarity.

Replace the cover.

ACCESSORIES

REAGENT SETS

HI 83740-20 Copper reagent set for wine (20 tests)

HI 83742-25 Color Reagent Set for wine (Wine Solvent-1)

OTHER ACCESSORIES

HI 740027P 1.5V AA batteries (10 pcs)

HI 731318 Tissue for wiping cuvets (4 pcs)

HI 731321 Glass cuvets (4 pcs)

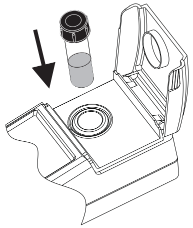
HI 731325W Caps for cuvets (4 pcs)

HI 93703-50 Cuvets cleaning solution (230 mL)

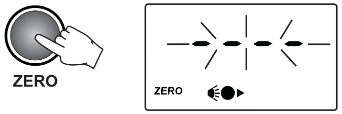
HI 740231 20 mL glass cylinder with caps (2 pcs)

- Insert the zero (cuvet #1) into the holder and close the lit.

#1 (Zero)



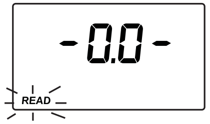
- Press ZERO and "----" will blink on the display.



- After a few seconds the display will show "-0.0-". The meter is now zeroed and ready for measurement

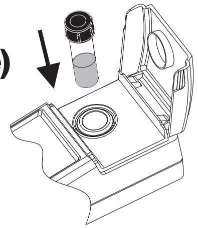
  Note:

  If the "L Lo" (Low Light) message appears, the sample must be diluted. See "General tips for an accurate measurement" (page 12).



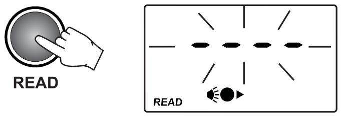
- Remove the cuvet from the instrument.

#2 (Sample)



- Insert the reacted sample (cuvet #2) into the holder and close the lid.

- Press READ and the display will show "----" during measurement.



- The instrument directly displays concentration in mg/L (ppm) of copper on the Liquid Crystal Display.

  Note:

  If the copper concentration exceeds 1.50 ppm or if the sample is very turbid or dark red colored, it is recommended to dilute the sample 10 times with **HI 83742-1** Wine Solvent-1 and repeat the complete measurement procedure starting from the beginning, taking 15 mL of diluted wine sample in vial #1 for zero-sampling and 15 mL in vial #2 for reading. In this case the displayed value needs to be multiplied by 10 to compensate for dilution.

SPECIFICATIONS

Range	0.00-1.50 mg/L
Resolution	0.05 mg/L
Precision	SD ±0.05 mg/L @ 0.50 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 560 nm
Light Detector	Silicon Photocell
Method	The reaction between Copper and the reagents causes a purple tint in the sample.
Environment	0 to 50°C (32 to 122°F); max 95% RH non-condensing
Battery Type	4 x 1,5 volt AA batteries / 12 to 20 VDC through voltage adapter
Auto-Shut off	After 15' of non-use in *measurement mode*.
Dimensions	225 x 85 x 80 mm (8.7 x 3.3 x 3.1")
Weight	500 g (17,6 oz.).

REQUIRED REAGENTS

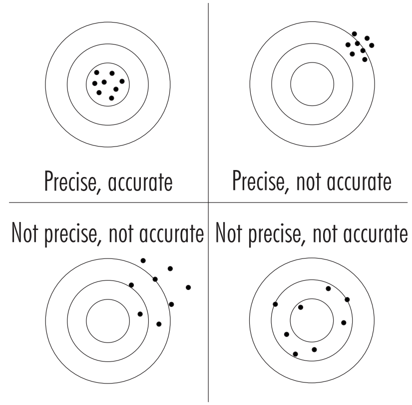
Code	Description	Quantity/test
HI 83740A-0	Copper Reagent A	5 mL
HI 83740B-0	Copper Reagent B	5 mL
HI 83740C-0	Copper Reagent C	2 x 4 spoons
HI 83740D-0	Copper Reagent D	2 x 4 spoons

PRECISION AND ACCURACY

Precision is how closely repeated measurements agree with each other. Precision is usually expressed as standard deviation (SD). Accuracy is defined as the nearness of a test result to the true value.

Although good precision suggests good accuracy, precise results can be inaccurate. The figure explains these definitions.

In a laboratory using a standard solution of 0.50 mg/L copper and a representative lot of reagent, an operator obtained with a single instrument a standard deviation of 0.05 mg/L.



PRINCIPLE OF OPERATION

Absorption of Light is a typical phenomenon of interaction between electromagnetic radiation and matter. When a light beam crosses a substance, some of the radiation may be absorbed by atoms, molecules or crystal lattices.

If pure absorption occurs, the fraction of light absorbed depends both on the optical path length through the matter and on the physical-chemical characteristics of the substance according to the Lambert-Beer Law:

$$-\log I/I_o = \varepsilon_\lambda \, c \, d$$

or

$$A = \varepsilon_\lambda \, c \, d$$

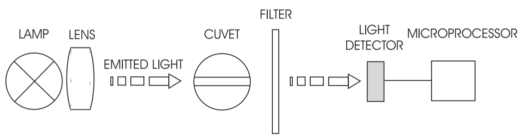
Where:

$-\log I/I_o$	=	Absorbance (A)
I_o	=	intensity of incident light beam
I	=	intensity of light beam after absorption
ε_λ	=	molar extinction coefficient at wavelength λ
c	=	molar concentration of the substance
d	=	optical path through the substance

Therefore, the concentration "c" can be calculated from the absorbance of the substance as the other factors are known.

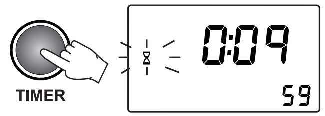
Photometric chemical analysis is based on the possibility to develop an absorbing compound from a specific chemical reaction between sample and reagents. Given that the absorption of a compound strictly depends on the wavelength of the incident light beam, a narrow spectral bandwidth should be selected as well as a proper central wavelength to optimize measurements.

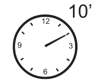
The optical system of Hanna's **HI 83000** series colorimeters is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.



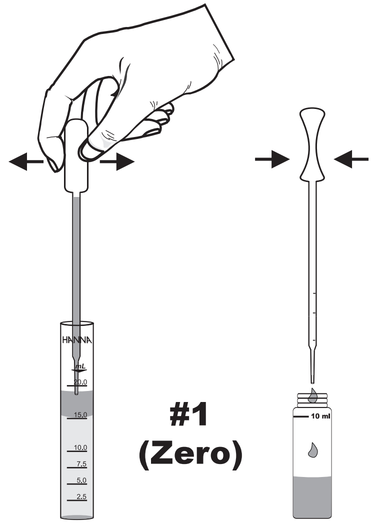
Block diagram (optical layout)

- Press TIMER and the instrument will show the countdown or, alternatively, wait for 10 minutes, leaving the vials capped and undisturbed.
  During this period the color of the upper layer (organic phase) in vial #2 will turn purple if copper is present.
  After 10 minutes the instrument gives an acoustic signal to alert the user that the countdown has finished.

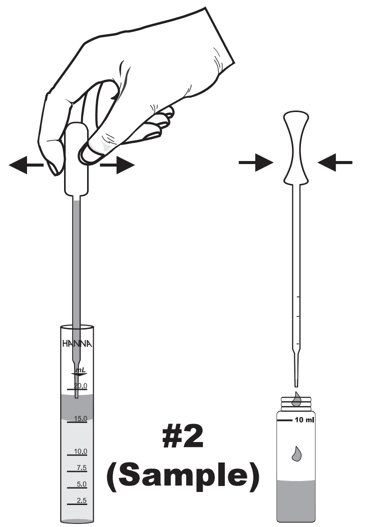




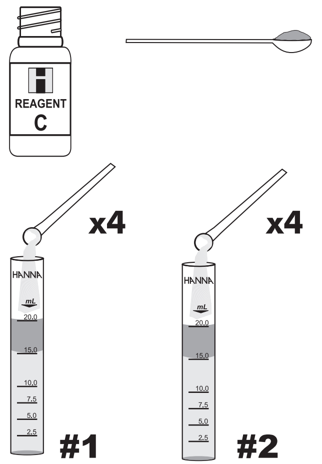
- Remove the cap of vial #1. Use the 3 mL plastic pipette to transfer the upper layer (organic phase) into a cuvet. **Ensure that at least 1/3 of the cuvet is filled with organic solvent** (see page 11).
  If some wine is transferred too, this does not interferes with the measurement.
  Cap the cuvet. This is the **zero** (#1).
  Note:
  The upper layer is an emulsion of small wine drops dispersed in the organic phase. Please note that an emulsion is an unstable equilibrium that may separate even after few minutes. It is therefore important to measure both the zero and the sample immediately after the countdown has finished.
  In case the emulsion separates before measurements can be made, we recommend to leave the vials standing for at least 4 hours, allowing complete separation of the emulsion and obtaining two clear solutions in the cuvets. Since the developed color is very stable, the cuvets may be left standing overnight to be read also next morning.



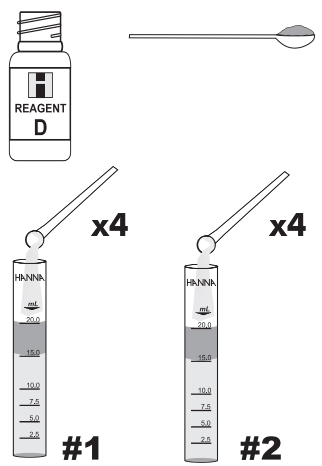
- Remove the cap of vial #2. Use the 3 mL plastic pipette to transfer the upper layer (organic phase) into another empty cuvet (see page 11).
  If some wine is transferred too, this does not interferes with the measurement.
  Cap the cuvet. This is the reacted **sample** (#2).



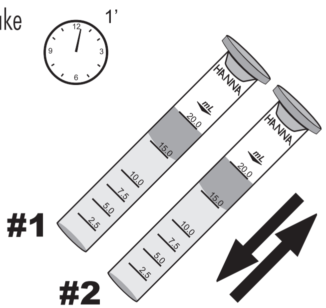
- Add 4 full spoons of reagent **C** to each vial.



- Using the other supplied spoon, add 4 full spoons of reagent **D** to each vial.



- Close the glass vials tightly with their caps and shake both vials <u>vigorously</u> for 1 minute.
  <u>Note</u>: block the cap with a finger during shaking!



A microprocessor controlled special tungsten lamp emits radiation which is first optically conditioned and beamed to the sample contained in the cuvet. The optical path is fixed by the diameter of the cuvet. Then the light is spectrally filtered to a narrow spectral bandwidth, to obtain a light beam of intensity I_0 or I.

The photoelectric cell collects the radiation I that is not absorbed by the sample and converts it into an electric current, producing a potential in the mV range.

The microprocessor uses this potential to convert the incoming value into the desired measuring unit and to display it on the LCD.

The measurement process is carried out in two phases: first the meter is zeroed and then the actual measurement is performed.

The cuvet has a very important role because it is an optical element and thus requires particular attention. It is important that both the measurement and the calibration (zeroing) cuvets are optically identical to provide the same measurement conditions. Whenever possible use the same cuvet for both. It is necessary that the surface of the cuvet is clean and not scratched. This to avoid measurement interference due to unwanted reflection and absorption of light. It is recommended not to touch the cuvet walls with hands.

Furthermore, in order to maintain the same conditions during the zeroing and the measuring phases, it is necessary to close the cuvet to prevent any contamination.

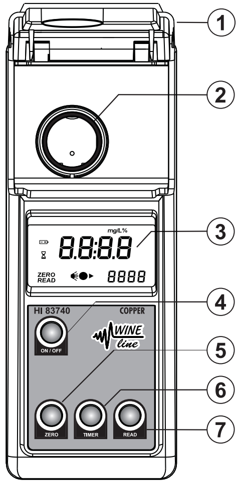
ABBREVIATIONS

EPA: US Environmental Protection Agency
°C: degree Celsius
°F: degree Fahrenheit
mg/L: milligrams per liter. mg/L is equivalent to ppm (part per million)
mL: milliliter
LCD: Liquid Crystal Display

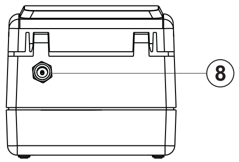
FUNCTIONAL DESCRIPTION

INSTRUMENT DESCRIPTION

FRONT

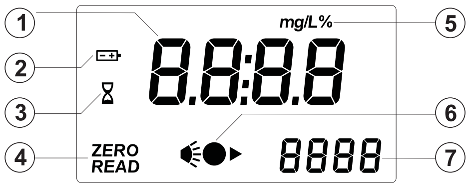


REAR



1) Lid
2) Cuvet Holder
3) Liquid Crystal Display (LCD)
4) ON/OFF key, to turn the meter on and off
5) ZERO key, to zero the meter
6) TIMER key, to activate a countdown
7) READ key, to perform measurement
8) Power Socket 12V to 20V DC 2.5 Watt

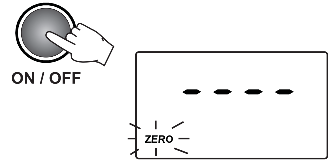
DISPLAY ELEMENTS DESCRIPTION



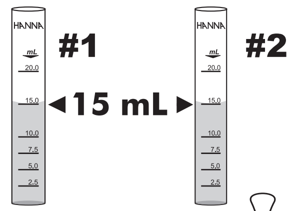
1) Four digit main display.
2) Battery icon: appears when the battery voltage is getting low.
3) The hourglass icon: appears during the countdown.
4) Status information.
5) Measurement unit.
6) Lamp status indicator.
7) Four digit secondary display.

MEASUREMENT PROCEDURE

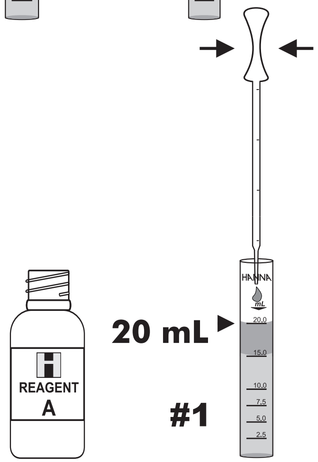
- Turn the instrument on by pressing ON/OFF.



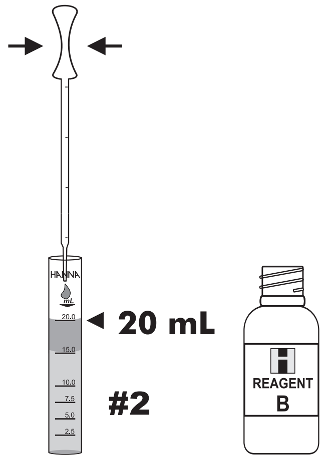
- When the LCD displays "---", it is ready.
- Use the 3 mL plastic pipette to fill two glass vials with 15 mL of wine sample (up to the mark).
  Note: The liquid in the vial forms a convexity on the top; the bottom of this convexity must be at the same level of the mark.



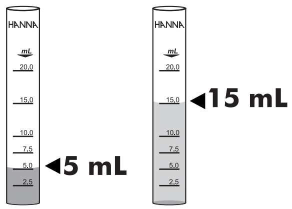
- Use a clean 1 mL pipette to add 5 ml of Reagent A to the first vial (#1)

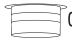


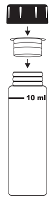
- Use the second 1 mL pipette to add 5 ml of Reagent B to the second vial (#2)



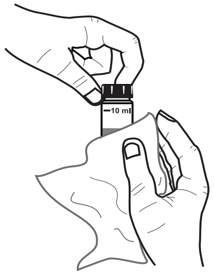
- <u>Diluting procedure</u> of the wine sample in case the "L Lo" (Low Light) message appears: use the pipette to fill the glass vials with 5 mL of wine sample (both vials), then fill the vials up to the 15 mL mark with **HI 83742-1** Wine Solvent-1. This is the diluted wine sample. The final reading must be multiplied by 3 to compensate for dilution.



- In order to avoid reagent leaking and to obtain more accurate measurements, it is recommended to close the cuvet first with the supplied HDPE plastic stopper  and then with the black cap.



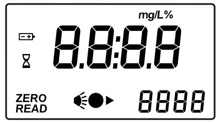
- Whenever the cuvet is placed into the measurement cell, it must be dry outside, and completely free of fingerprints, oil or dirt. Wipe it thoroughly with **HI 731318** (tissue for wiping cuvets, see chapter ACCESSORIES) or a lint-free cloth prior to insertion.



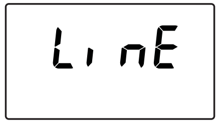
- Read the cuvets immediately after extraction.
  In case of unstable readings or for more accurate results, let the reacted cuvets stand for <u>at least</u> 4 hours, allowing complete separation of the formed emulsion.

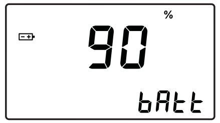
- Before taking a measurement, verify that no air bubbles or water drops are attached to the walls of the glass cuvet.

GUIDE TO DISPLAY CODES

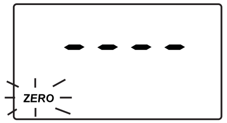


This prompt appears for a few seconds each time the instrument is turned ON.

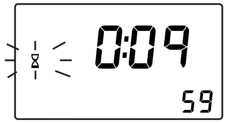




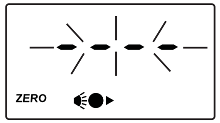
These prompts indicate the type of power supply: "Line" (if the external power supply is used) or the battery level.



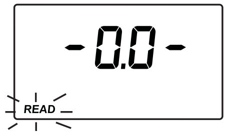
Indicates that the instrument is in a ready state and waiting for the next command (Timer or Zero).



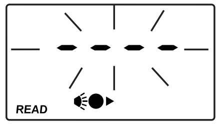
After Timer is pressed, a blinking hourglass icon appears and the display shows a 10 minutes coundown. Also the Zero tag might blink if no zero measurement has been made before. At the end, an acoustic signal alerts the user that the countdown has finished.



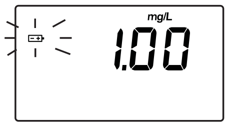
Indicates that the meter is performing a zero measurement. The light intensity is automatically re-adjusted (auto-calibration features) if necessary.



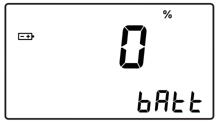
The instrument is zeroed and a measurement can be made.



Indicates that the meter is making a measurement.



Batteries voltage is getting low and the batteries need to be replaced.



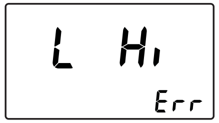
Indicates that the batteries are dead and must be replaced. After this message appears, the instrument is switched off. Change the batteries and restart the meter.

ERROR MESSAGES

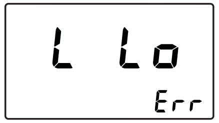


The meter has lost its configuration. Contact your dealer or the nearest Hanna Customer Service Center.

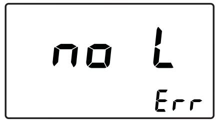
a) on zero reading:



"Light high": there is too much light to perform a measurement. Please check the preparation of the zero cuvet.

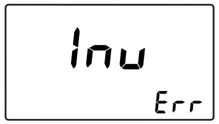


"Light low": there is not enough light to perform a measurement. Dilute the sample. See "General tips for an accurate measurement" (page 12).

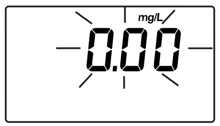


"No Light": the instrument cannot adjust the light level. Please check that the sample does not contain any debris.

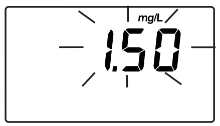
b) on sample reading:



"Inverted": the sample and the zero cuvet are inverted.



The sample absorbs less light than the zero reference.
Check the procedure.

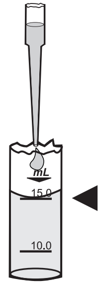


A flashing value of the maximum concentration indicates an over range condition. The concentration of the sample is beyond the programmed range: dilute the sample and measure again.

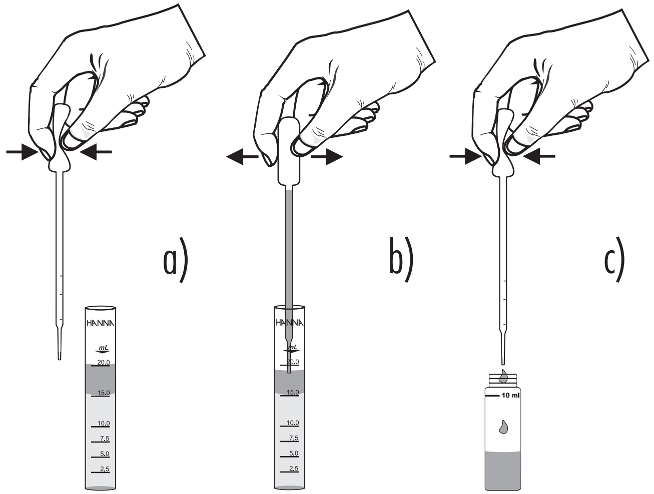
GENERAL TIPS FOR AN ACCURATE MEASUREMENT

The instructions listed below should be carefully followed during testing to ensure best accuracy.

- Use the supplied plastic pipette for adding the exact amount of wine sample (15 mL) or reagents A or B (up to the 20 mL mark) to the graduated glass vials. The liquid in the vial forms a convexity on the top; the bottom of this convexity must be at the same level of the mark.



- To transfer the supernatant organic solvent from the vials to the cuvets use two different clean 1 mL pipettes, one for the zero and one for the sample.
  a) squeeze the bulb of the pipette;
  b) insert the plastic pipette into the supernatant organic solvent and release the bulb slowly, paying attention not to transfer the wine sample too;
  c) fill a cuvet with organic solvent by squeezing the bulb of the pipette.



Repeat step a), b) and c) until all the organic solvent is transferred. **Ensure that at least 1/3 of the cuvet is filled with organic solvent,** otherwise erroneous results will be obtained.

Notes:

- If some wine sample is transferred too, this does not interferes with the method.
- Try to avoid transferring suspended solids that might be present.
- If necessary, air bubbles can be removed tapping the vials gently on the table.